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the like-named structures in horses' teeth. They profess ability to examine a river's mouth and tell as shrewdly as any veterinarian whether the animated stream belongs to the colt stage, the four-year-old, or the decrepit old equine condition. To the discerning eye even pathologic conditions are revealed, for has not one writer described a stream with 'blind staggers'? Let any one cast a glance over the recent literature, if one suspects the simile overdone, and note, amongst other things, the surprising array of anthropomorphic conceptions of nature. Take even a master-craftsman like Professor Davis, originator, if I mistake not, of the terms 'pirate stream,' 'captured tributaries,' 'drowned valleys,' etc. (the hybrid 'peneplain' belongs to another story)—has he not said of Greece that it 'is a country standing up to its knees in the Mediterranean'? The fact may be literally true, but it is hardly decorous to specify anatomical particulars.

Another writer who believes in the virtue of parables characterizes a rapidly eroded land-surface as a 'precocious infant,' from which the lay reader may surmise that it has just graduated from kilts. But for delightfully refreshing imagery we must refer to a short article on 'The Aggrading Bar,' which appeared in these columns some little time ago (SCIENCE, V., p. 646), and begins as follows:

"The little wriggling bar staggering blindly along in a broad meandering valley is like a small boy attempting to fill his grandfather's boots. The waste supplied from the side of the hills of the adolescent valley, cut by the ancestor of the present stream, is much too great a load for a little brook."

Here the anthropomorphic suggestion is very skilfully rendered, in fact so realistically that the fate of this inebriate little brook, after taking on its load at the aggrading bar, might almost be said 'to point a moral or adorn a tale.' As class-room illustrations, or as intending to impart instruction by means of allegory, figurative descriptions of this nature may, perhaps, be tolerated, but it is gratuitous to suppose that the method of *Æsop* is better adapted to the needs of readers of SCIENCE than the method of *Zadig*. Sully

Prudhomme, in his essay 'On the Nature of Things,' makes some pointed remarks on the habit personifying inanimate nature, which it may be well for physiographers to take to heart.

Other illustrations of the kindergarten method might be given, but it is probably unnecessary to prove that the standard of most of our popular scientific magazines has become lowered through the habit of 'talking down' to average readers, instead of raised by talking just a little over their heads. Let it be asked as a general question which style of writing is the more helpful to students, that which assumes too much on their part, or too little? Does not there come a time in the education of youth when suggestion by means of nursery methods ceases to be a virtue? When a student reaches the point where he may be expected to dig for himself, let us put a spade into his hand, taking care, however, to call it a spade, and not a toy for making mud-pies.

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'VEGETABLE BALLS.'

REGARDING the subject of 'Vegetable Balls' the following additional information may be worthy of note. This curious formation is characteristic of the section *Ægagropila* of the genus *Cladophora* and is mentioned in Engler and Prantl's 'Die Naturlichen Pflanzenfamilien,' De Ionis 'Sylloge Algarum' and Hanck's 'Meeresalgen.' The most recent work on the subject seems to be that of C. Wesenberg on *Ægagropila Sauteri* (Overs. k. dansk. Vidensk. Selsk. Forh., II., 1903, pp. 168-203), of which there is a very good summary in *Jour. Roy. Micr. Soc.*, April, 1904. The alga occurs in Lake Sorö, Denmark, and the balls attain the size of the fist or of a child's head.

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June 29, 1904.

A NOTABLE PALEOBOTANICAL DISCOVERY.

TO THE EDITOR OF SCIENCE: Inasmuch as a note by the undersigned, entitled 'A Notable Paleobotanical Discovery,' in SCIENCE of July 8, was delayed in publication it is only just

to the writer to state that the article in question was written last January, before the final results of Professors Oliver and Scott had reached me, and that the footnotes which called attention to the later discoveries were added in April, when I read the proof.

With regard to the statement in the opening paragraph that the term *Cycadofilicales* was destined to become a permanent acquisition to taxonomy, I had in mind rather the idea that botanists would henceforward be unable to dispute the existence of paleozoic plants intermediate between the *Pteridophyta* and the *Gymnosperms*, rather than the question of terminology, and hence did not notice this slip of expression in a paper which further on mentions a new and vastly more appropriate name for the group in question.

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PASSAIC, N. J.

SPECIAL ARTICLES.

EVOLUTION AND PHYSICS.

EMINENT British biologists have recently visited severe criticisms* upon Lord Kelvin for giving voice to the opinion that evolution lies beyond the borders of physics and chemistry. The zeal with which they have hastened to the defense of current mechanical hypotheses of evolution apparently causes them to forget that it is exactly these physical conceptions with which Lord Kelvin may be supposed to be qualified to deal. And when Lord Kelvin admits that the 'forces,' 'principles,' 'energies' or other abstractions in use among physicists are not adequate for even a formal explanation of such biological phenomena as evolution, he states what is well-nigh axiomatic to some, and reaches a point of view appreciated by rapidly increasing numbers of biologists.†

The idea that there are biological phenomena essentially different from those of physics and chemistry has nothing to do with the theory of 'vital force' of half a century ago. It does not overlook the vast amount of physics

and chemistry already found in plants and animals, nor the probability that multitudes of similar facts remain to be discovered. To argue, however, from the progress of knowledge in these directions that all the phenomena of organic existence are to be explained in current physical terms is to imitate the balloonist who reasoned that he would be able to see all the way around the earth if he could only go high enough.

It is entirely possible, of course, to range organic evolution under chemistry or physics, but at present it seems not to assort well with the other phenomena treated in these sciences. The difference appears to be, furthermore, not merely one of degree, but of kind, so that it may well be asked whether it is not more scientific for Lord Kelvin to recognize and admit such a distinction, even though it may prove ultimately to have rested on a present limitation of knowledge, than for his critics to insist on the identity of phenomena between which no indication of relationship has been shown. At least we must expect that the unprejudiced layman will think it quite as possible that the biologists have been indulging in bad physics as that Lord Kelvin is totally in error with regard to the rôle of physical forces in biology. The outsider might even wonder why the eminent specialists from the two branches of knowledge are not organized as a joint committee to consider whether their fundamental conceptions are the same or not, instead of wasting time in mutual recriminations of ignorance. In the scientific world, such charges can not, of course, go amiss, but conscious ignorance is better than unsupported assertion.

Whether the formation of crystals should be called fortuitous or not is another question of words; it will hardly be insisted that it is a completely fortuitous 'concourse of atoms' which makes crystals of regular form from a solution stirred up in a beaker; to cover our ignorance we ascribe to some substances a special property named crystallization. If protoplasm could be obtained from a similar dissolved mixture of its ingredients, this would be ascribed by parity of ignorance and logic to 'plasmatisation' or whatever such a prop-

* SCIENCE, N. S., XVIII., 138, July 31, 1903.

† See, for example, 'A Text-book of Botany,' by Strasburger, Schenck, Noll and Schimper, p. 158, London, 1903.